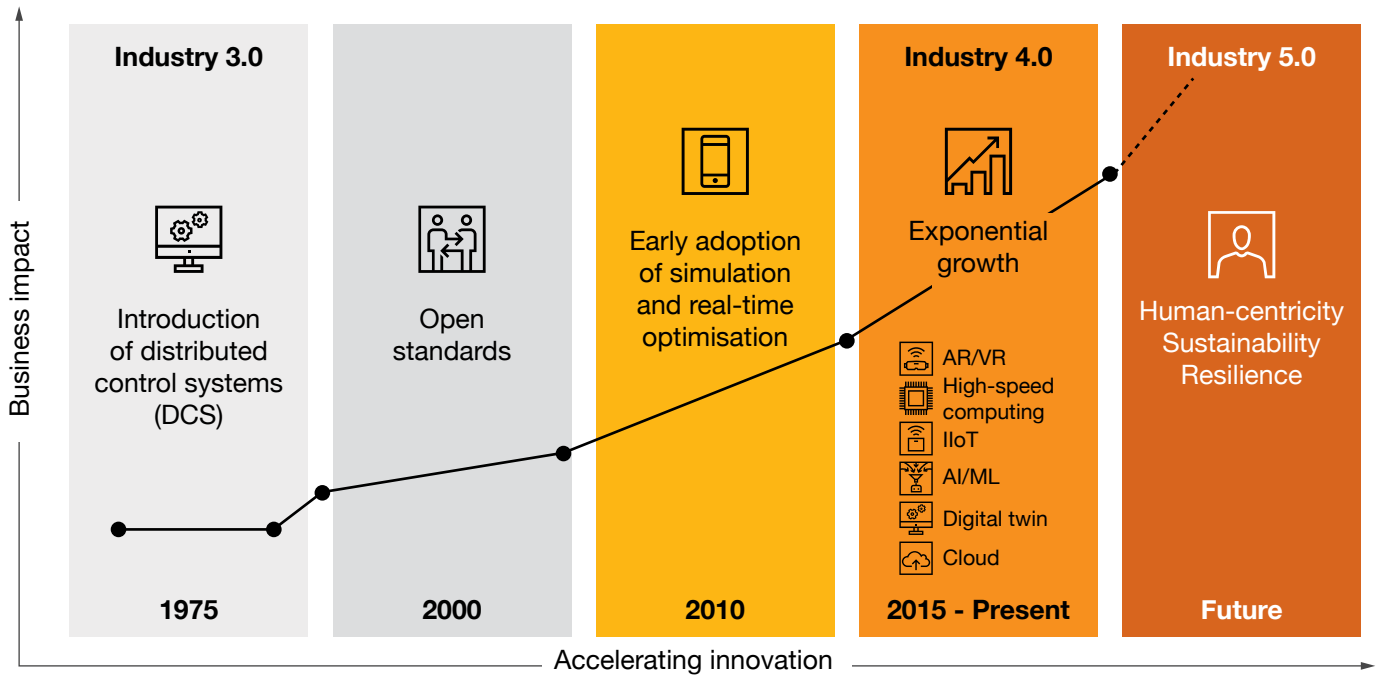
Three imperatives to drive human-centricity in the manufacturing landscape

The Fifth Industrial Revolution places humans at the centre of operational and production processes. **Sudipta Ghosh**, **Ankur Basu** and **Ajay Deshmukh** highlight three imperatives to drive the workforce-first approach of Industry 5.0.

From industrial value to holistic value

Technological advancements and innovations in recent years have revolutionised the manufacturing landscape, ushering in a new era of industrial growth. This trajectory owes much to the advent of industrial digitisation, which marks significant shifts in manufacturing and production methods.

Figure 1: The industrial revolutions



Source: PwC analysis

A human-centric approach in Industry 5.0 places human needs, safety and interests at the heart of the production process. Instead of focusing on what humans can do with new technology, Industry 5.0 asks what technology can do for humans?[1] Instead of the workforce adapting their skills to evolving technology, the Fifth Industrial Revolution aims at using technology to adapt production processes to the needs of a diverse workforce.[2] This is aligned with the imperative for companies to adapt to shifting workforce dynamics to enhance capabilities that can generate value-driven opportunities.

The recent PwC India research on Industry 5.0, **Decoding the Fifth Industrial Revolution**,[3] indicates that companies clearly acknowledge the need to prioritise employee development and engagement, and have gradually begun to perceive them through the lens of investment which yields holistic returns, rather than the lens of cost which erodes revenue. Three core imperatives can help Industry 5.0 to realise its human-centric promise:

- move from smart to cognitive technology
- empower the workforce to be Industry 5.0-ready
- improve workforce wellness.

1) Move from smart to cognitive technology

Unlike 'smart' technology that focuses on specific tasks with predefined intelligence, cognitive technology replicates more advanced cognitive functions associated with human intelligence. 'Smart' virtual assistants, for instance, can perform tasks based on pre-programmed commands; interaction is limited to these specific commands that rely on predefined scripts. Cognitive AI assistants, on their part, go beyond executing commands. Designed to comprehend context and intent, they can perform complex tasks; interaction is natural as they are able to respond to nuanced language and interpret emotions.

For instance, a smart predictive maintenance system could alert a technician that a machine's vibration levels are higher than normal, indicating a possible bearing failure. The technician would then be required to schedule a check-up. A cognitive predictive maintenance system is equipped to do more. For one, the technician would receive an alert on both the possible failure of the bearing, and an estimate of when that can happen. Such a system would also suggest the optimal time for maintenance based on production schedules, order replacement parts in advance, and offer instructions or video tutorials on how to perform the maintenance, based on the specific context of the detected issue.

This transition from smart to cognitive technology in predictive maintenance illustrates how manufacturing processes are becoming more pre-emptive and efficient. This shift showcases how the world is moving towards more sophisticated technologies that not only perform tasks but also understand and adapt to complex human needs and contexts.

With human-machine collaboration at the forefront, the technologies including human-centred artificial intelligence (HCAI)[4] are designed to augment rather than replace human capabilities to create more adaptive and responsive systems. Employees on their part are also open to embracing new technologies and benefiting from them.

And yet, the inability to provide secure access to GenAI and similar such technologies to enhance workforce productivity is a challenge for many executives across industries such as chemicals (77%), textiles and clothing (57%), cement (53%) and automotive (30%).[5]

1 European Commission, Industry 5.0

2 Ibid.

3 PwC, Decoding the Fifth Industrial Revolution

4 Shneiderman, B. Human-centered artificial intelligence: Reliable, safe & trustworthy. Int. J. Hum. Comput. Interact. 2020, 36, 495–504

5 PwC, Decoding the Fifth Industrial Revolution

Clothes manufacturers, for example, are trying to explore GenAI for rapid prototyping and acceleration of the design process. However, challenges remain. Ensuring the safety of proprietary designs that GenAI models need access to, implementing strong authorisation mechanisms to control who has access to modify the GenAI tools, and training the workforce on potential security risks are areas that still need to be addressed.

2) Empower the workforce to be Industry 5.0-ready

With human-machine synchronisation, the workforce will need to be upskilled to bridge the gap between their current skill sets and those required for the next level of industrialisation. Creative problem solving, digital proficiency, emotional intelligence and data literacy will gain prominence. Industry 5.0 therefore envisions continuous learning and skill development for employees while offering flexible work environments.

With this in mind, organisations are using GenAI to customise training programmes to suit individual employees' needs and career goals. Manufacturing companies are exploring the use of GenAI to simulate factory settings and train shop floor workers on complex machinery in a risk-free environment.

Moreover, with robots taking over repetitive tasks and those demanding heavy physical labour, the Fifth Industrial Revolution can render workplaces safer for workers while also democratising opportunities for one and all in the working environment.[6] Digitalising industrial processes will also enable remote work, allowing those living in distant regions to enter the labour market.[7] Workers too would be motivated to acquire new skills with a strong emphasis on quality and consistency in their work.

Companies are also identifying opportunities to strengthen and empower their workforce. As per our survey, 79% of business leaders want to upskill at least 50% of their workforce to work with advanced digital technologies and machines in the next one to two years, and 28% of the organisations say they have scaled up customised skilling mechanisms using technologies such as augmented reality (AR), virtual reality (VR) and GenAI to make training enjoyable and accessible to the workforce at any time.[8]

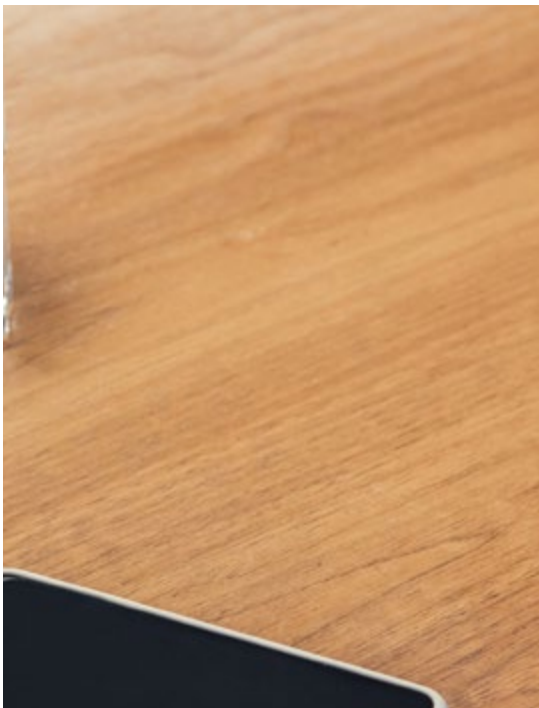
3) Improve workforce wellness

Enhancing worker well-being and resilience is a key tenet of Industry 5.0. The workforce is now seeking comprehensive measures that prioritise their well-being and safety. This has prompted companies to deploy digital solutions to improve the physical and mental health conditions of their workforce.

A case in point is that of an automobile manufacturer that has employed VR-based training for its assembly line workers and reported significant injury reduction. In another manufacturing company, safety measures for workers are taught through AR and VR. For instance, when a worker climbs a transmission line tower, the worker wears a mixed-reality headset. Using multiple sensors, advanced optics and holographic processing that melds seamlessly with its environment, these holograms display information, blend with the real world, or even simulate a virtual world and show the worker how to go about the task safely.

When designing digitised workplaces, it is important to factor in ethical considerations and ensure that the tools and technology do not undermine the dignity of the worker[9] or breach their privacy while harnessing the collective intelligence of man and machine. Therefore, the three imperatives are key to the human-centric vision that is at the core of Industry 5.0.

A potential use case involving a manufacturing plant demonstrates how these principles can be put into practice to boost productivity and resilience while ensuring continuous learning and employee satisfaction.



6 European Commission, Industry 5.0

7 Ibid.

8 PwC, Decoding the Fifth Industrial Revolution

9 European Commission, Industry 5.0

Use case: Unleashing human ingenuity using next-gen plant analytics

While Industry 5.0 encompasses a range of technologies, one particularly promising solution combines advanced analytics models – trained on historical plant issues and troubleshooting techniques – with enhanced knowledge-sharing and personalised human capital development plans.

As-is state

The current systems based on the Industry 4.0 approach rely on a collaborative mechanism called the 'Integrated Process Operations Framework' which is responsible for the transmission of production-related insights from the plant level to the boardroom, where strategic decisions are made. This integrated process operations framework consists of three major components:

1. An overarching operating envelope detailing various process parameters and their operating limits. This operating envelope further includes instructions, shift monitoring tools, and a shift reporting tool, often referred to as Handover, Takeover or HOTO.
2. Alarm analysis and a rationalisation tool model equipped with real-time monitoring of online process parameters with corresponding operating limits pre-fed into the system for highlighting any deviation – untoward or otherwise.
3. A mobility platform providing enhanced system connectivity for on-ground activities and real-time support.

Post completion of every shift activity, every single action that was conducted and every incident that took place during the shift are recorded in a digital shift logbook for keeping records. This logbook, when implemented as a database of all plant-related incidents and activities, can be augmented with advanced analytical tools to generate a wealth of information.

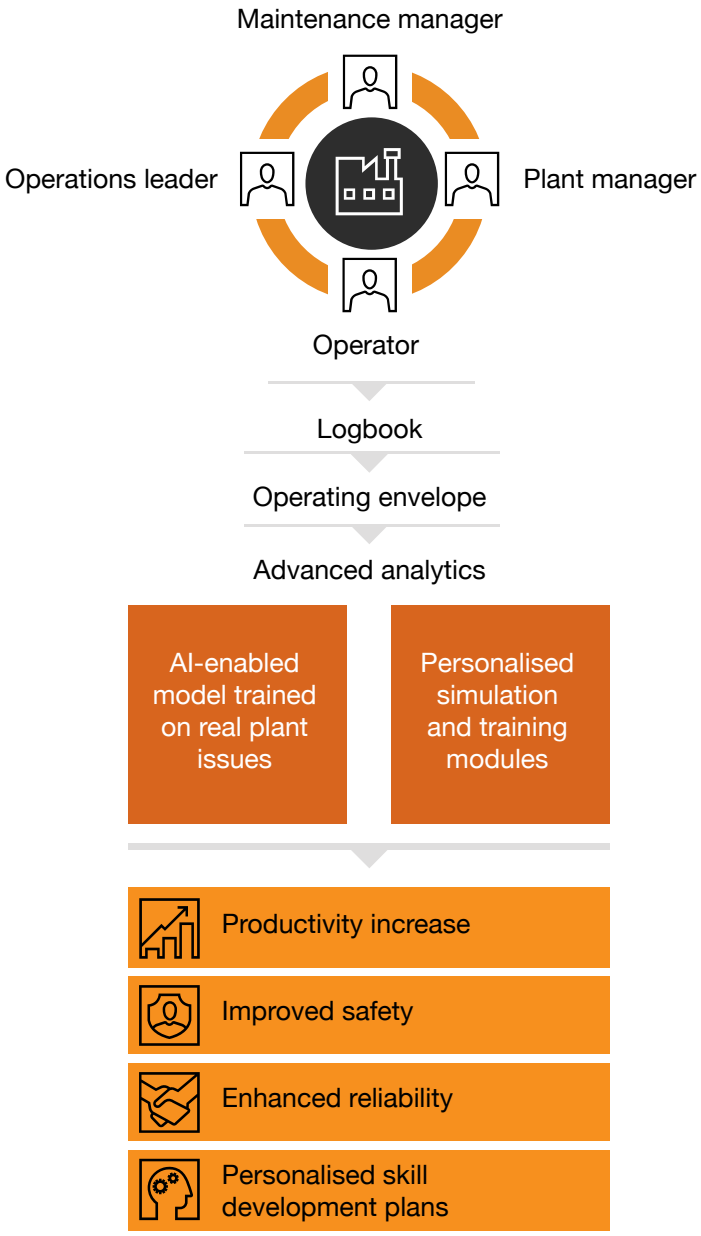
To-be state

While the plant is equipped with standard operating procedures (SOPs), the way it is run is largely dependent on human input and decision making, informed by the expertise of running the plant in a safe, reliable and timely manner that comes with years of experience. This indicates that human skill and experience are critical in determining how smoothly the plant would operate. Combining human expertise with modern analytics tools can lead to the generation of value on multiple fronts for an organisation.

- **Man-machine collaboration for enhanced reliability:** The digital logbooks which hold large amounts of plant data can be used in combination with natural language processing (NLP) and specialised AI/ML models equipped to learn and assimilate years of plant data to derive insights. Such a tool will not only highlight issues that can hamper smooth operations but also suggest the best mitigation measure based on historical records. This would also enable younger, less experienced executives to make better decisions with increased confidence and reliability in high-stress situations.

- **Performance analysis for better productivity:** Once prepared, this tool can also be used for performance analysis and benchmarking of various shift in-charges and their level of competence based on their handling of plant issues from a historical data standpoint. The insights generated could also help the management pinpoint that productivity differences in different shifts are a result of differences in competence level, which are built by handling abnormal situations that may arise. Once candidates who underperform with respect to a chosen benchmark are identified, specialised training could be arranged for such individuals.
- **Personalised skill development:** The use case can also be employed to drastically improve employee learning and development by creating personalised training modules. Using the insights generated, the employee can leverage digital twins and simulations to practice and perform troubleshooting activities in a simulated environment without disrupting normal plant operations. The simulations may be created in order to replicate abnormal situations that have been identified in the logbook. Assessment of the individual could be conducted by benchmarking the steps the learner takes vis-à-vis the SOPs and best practices which were also highlighted in the logbook analysis.

Figure 2: Moving from the as-is to the to-be state



Source: PwC analysis

Looking ahead

Companies are slowly recognising the need for business model reinvention to build human-centric value proposition-based products, services and experiences. They are focusing on building operating models to provide opportunities for upskilling and reskilling employees and to create an environment that encourages learning, experimentation and innovation.

However, businesses are still struggling to scale up in areas such as digital twinning and human-machine collaboration. Certain challenges need to be addressed to accelerate the adoption of Industry 5.0. These include:

- The workforce perceives machines/robots and digital technologies as threats to their jobs and incomes.
- Organisations lack substantive training to maximise value from human-machine collaboration or offer poor on-the-job virtual training.
- Organisations are unable to track and understand workforce aspirations towards leveraging emerging technologies.
- Companies are unable to provide secure access to GenAI and similar such technologies to enhance workforce productivity, sustainability and efficiency.
- Poorly executed inclusion and diversity policies are often demotivating.

It is evident then that multiple actions will be required on the part of both the employer and the employee. While employees need to place their trust in technology, companies need to take initiatives to empower them to trust technology. The good news is that companies are investing in capabilities that are central to the vision of Industry 5.0. Forward-thinking companies looking to stay ahead of the curve emphasise that their immediate priorities include listening to continuous feedback and scaling up this ability so that they can provide employees with meaningful work to boost their job satisfaction, alongside smart and engaging skilling initiatives.[10]

Also contributing to this article were **Vishnupriya Sengupta, Ruchika Uniyal, Arnab Chakraborty** and **Mohit Prasad.**

10 PwC, Decoding the Fifth Industrial Revolution